MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

TO: File for 1-Tetradecene (CAS # 1120-36-1)

FROM: Doreen Lehner, Toxics Unit, Air Quality Division

SUBJECT: Screening Level for 1-Tetradecene (CAS # 1120-36-1)

DATE: August 19, 2014

The initial threshold screening level (ITSL) for 1-tetradecene is 29 µg/m³ based on an annual averaging time.

A literature review was conducted to determine an initial threshold screening level (ITSL) for 1-tetradecene. The following references and databases were searched to derive the above screening level: Chemical Criteria Database (CCD), United States Environmental Protection Agency (US EPA) Integrated Risk Information System (IRIS), National Institute for Occupational Safety and Health (NIOSH), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values and Biological Exposure Indices (TLV/BEI) 2012 Guide, National Toxicology Program (NTP) Study Database, International Agency for Research on Cancer (IARC), Acute Database, Chemical Abstract Service (CAS) Online (searched 6/11/14), National Library of Medicine (NLM)-online, EPA Aggregated Computational Toxicology Resource (ACToR) Database, and EPA Toxic Substance Control Act Test Submission Database (TSCATS).

1-Tetradecene (CAS# 1120-36-1) is also known as n-tetradecene, α-tetradecene, and alpha olefin C14. This chemical is a colorless liquid with a melting point of -12°C, a boiling point of 250°C, and a molecular weight of 196.37212 g/mol. 1-Tetradecene is used as: a component of drilling fluids; a replacement for certain hydrocarbon solvents; and an intermediate in the production of oxo-alcohol, amine amine oxide, mercaptan, and synthetic lubricants (OECD, 2001). 1-Tetradecene, “may be released to the environment as a fugitive emission during its production and use, and as a result of the burning of plastics. If released to soil, 1-tetradecene will be essentially immobile. It may rapidly volatilize from moist soil to the atmosphere although its expected strong adsorption to soil may attenuate the rate of this process. 1-Tetradecene will not volatilize from dry soil to the atmosphere. Pure culture studies indicate that 1-tetradecene has the potential to biodegrade in soil and water under aerobic conditions. If released to water, 1-tetradecene will bioconcentrate in fish and aquatic organisms and strongly adsorb to sediment and suspended organic matter. It may rapidly volatilize from water to the atmosphere. The estimated half-life for volatilization from a model river is 4.1 hrs. Its expected strong adsorption to sediment and suspended organic matter may attenuate the rate of this process. The estimated half-life for volatilization from a model pond, which takes into account adsorptive processes, is 7.3 months. If released to the atmosphere, 1-tetradecene may undergo removal by gas-phase reaction with atmospheric oxidants. Estimated half-lives for the reaction with photochemically produced hydroxyl radicals and ozone are 9.3 hrs and 23 hrs. Occupational

exposure to 1-tetradecene may occur by inhalation or dermal contact during its production, formulation or use." (HSDB, 2014).

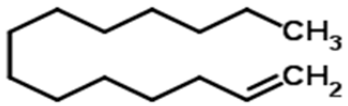

Figure 1. Structure of 1-tetradecene.

ITSL Derivation:

A reproductive, developmental, and neurotoxicity study conducted by Daniel (1995) used one control group and three treatment groups with 12 males and 20 female Sprague-Dawley rats. Doses were 0 (vehicle corn oil only), 100, 500, or 1,000 mg/kg/day 1-tetradecene (in corn oil) orally by gavage for up to 51 days. Control groups were given corn oil at equivalent dose volume to treated groups (5 ml/kg). The F0 males were treated for 28 days prior to mating, during mating, and until the day prior to euthanasia (43-47 days). Twelve F0 females were dosed 14 days prior to mating and during mating, gestation, and lactation until postnatal day 4 (42-51 days) when F0 females and F1 pups were euthanized. The eight remaining females per group were a satellite group for evaluation of neurotoxicity, clinical pathology and histology parallel to the breeding males, but were not bred (45-47 days). All F0 males and satellite females were evaluated for motor activity, clinical pathology, and functional observational battery before euthanasia. Animals were observed daily for signs of toxicity, and body weights and food consumption were measured at intervals. All F0 males and females were subjected to gross necropsy when euthanized. Microscopic examination was conducted on gross lesions from all animals, on selected tissues from five randomly selected males and females from the control and high dose groups, and on the lungs, liver, kidneys, and reproductive tracts of all females.

Salivation and urine staining were noted in all non-control animals. Dose-related hydrocarbon nephropathy was noted in kidneys of male rats in all groups. Male and female rat livers showed increases in liver weights and hepatocyte cytoplasmic vacuolation in the 500 and 1,000 mg/kg/day dosage level groups. There were no test article-related differences in the functional observational battery and motor activity tests that would indicate neurotoxicity. The NOAEL for neurotoxicity was 1000 mg/kg/day in males and females. For systemic effects, the NOAEL was 100 mg/kg/day in the satellite females. There was no evidence of impaired reproductive capabilities in the F0 generation an no evidence of developmental toxicity in the F1 generation through postnatal day 4. The NOAEL for reproductive, developmental, or neurotoxicity was 1000 mg/kg/day in both males and females. Since hydrocarbon nephropathy was seen in all male dose groups, there was not a NOAEL for male rats for systemic toxicity. However, male rat hydrocarbon nephropathy is unique to the male rat, and does not suggest an adverse effect for human risk assessment (Daniel, 1995).

According to Rule 232(1)(e) an ITSL can be determined from an oral study of 7 days or longer duration that produces a NOAEL or LOAEL using the following equation:

$$ITSL = \frac{NOAEL\ ({}^{mg}/_{\frac{kg}{day}})}{35\ \times 100} \times \frac{W_A}{I_A} \times \frac{b}{a}$$

Where:
W_A = body weight of Sprague-Dawley rat in kg.
I_A = daily inhalation rate of Sprague-Dawley rat in m^3/day.
b = absorption efficiency via oral route.
a = absorption efficiency via inhalation route.
In the absence of absorption efficiency data. The value for a/b = 1. Since the NOAEL for systemic liver toxicity is 100 mg/kg/day for female Sprague-Dawley rats, the average body weight of the female Sprague-Dawley rat of 0.338 kg is used in this equation. The daily inhalation rate (I_A) is determined by the following equation taken from EPA (1988) below:

$$I_A = 0.80\ \times\ W^{0.8206}$$

Where:
I = inhalation rate in m^3/day.
W = body weight in kg.
Inputting the average weight of the female Sprague-Dawley rat of 0.338 kg into the equation above gives:

$$I_A = 0.80\ \times\ 0.338\ kg^{0.8206} = 0.328487639\ {}^{m^3}/_{day}$$

Using the ITSL equation above gives:

$$ITSL = \frac{100\ {}^{mg}/_{kg/day}}{35\ \times 100} \times \frac{0.338\ kg}{0.328487639\ {}^{m^3}/_{day}} \times \frac{1}{1} = 0.029398801\ {}^{mg}/_{m^3}$$
$$= 29.3988\ {}^{\mu g}/_{m^3}$$

The ITSL is rounded to 29 µg/m^3. Based on Rule 232(2)(c) the averaging time is annual. Therefore, the initial threshold screening level (ITSL) for 1-tetradecene is 29 µg/m³ based on an annual averaging time. It may be noted that the Rule 232(1)(e) equation is designed for a subchronic study duration of 7 days; while the key study had an exposure duration that was significantly longer than 7 days it was subchronic nevertheless. There is a lack of guidance for a more appropriate subchronic-to-chronic adjustment factor in such instances. This approach adds conservation to the ITSL calculation.

References:

Act 451 of 1994, Natural Resources and Environmental Protection Act and Air Pollution Control Rules, Michigan Department of Environmental Quality.

Daniel EM. 1995. "Combined Repeated Dose Toxocity Study/Reproduction/Developmental Toxicity Screening Test in Rats with 1-Tetradecene." Final Report. Springborn Laboratories, Inc. (SLS) Life Sciences Division, Spencerville, Ohio. NTIS. 8EHQ-1195-13255. National Technical Information Service. Springfield, VA 21161.

EPA. 1988. Recommendation for and documentation of biological values for use in risk assessment. PB 88-179874.

HSDB. 2014. Hazardous Substances Data Bank [Internet]. Bethesda (MD): National Library of Medicine (US); [Last Revision Date 2011; cited 2014 August]. 1-Tetradecene; Hazardous Substances Databank Number: 1087. Available online at: http://toxnet.nlm.nih.gov/cgi-bin/sis/search2/f?./temp/~9E5lhI:3

OECD. 2001. OECD SIDS Alfa Olefins CAS N°: 592-41-6, 111-66-0, 872-05-9, 112-41-4, 1120-36-1. Initial Assessment Report for 11th SIAM. UNEP Publications. Available online at: http://www.inchem.org/documents/sids/sids/AOalfaolefins.pdf

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